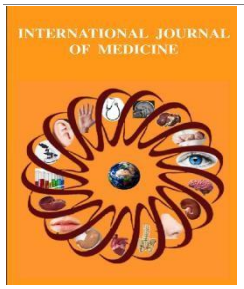

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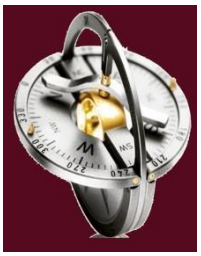

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Research Article

Prevalence of Genital Tract Infections and Microbiota Disturbances in Infertile Women: Implications for Reproductive Health

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Abstract
Introduction: Female infertility is a multifactorial condition with microbial dysbiosis and asymptomatic genital tract infections emerging as key contributors. This study aimed to evaluate the prevalence, microbial profile, and antimicrobial resistance (AMR) patterns among infertile women attending a tertiary care center. ***Materials and Methods***: A prospective observational study was conducted on 246 infertile women. Vaginal and cervical swabs were examined by wet mount, Gram staining, culture, and PCR for sexually transmitted pathogens. Antibiotic susceptibility testing (AST) was performed using CLSI 2021 guidelines. ***Results***: Culture positivity was 62.2% (153/246). The predominant isolates included Staphylococcus aureus (n=21), Escherichia coli (n=16), and Candida albicans (n=14). Asymptomatic carriage (64.1%) exceeded symptomatic cases (35.9%). Candida prevalence was 5.7% and Trichomonas vaginalis 3.3%. ESBL product ion was highest among E. coli (50%). Six tables summarize demographics, isolates, symptomatic distribution, Candida/Trichomonas prevalence, and AMR profiles. ***Conclusion***: Asymptomatic genital tract infections are common in infertile women and significantly affect reproductive outcomes. Integration of microbiota and AMR screening in infertility workups is recommended.

Keywords: Female infertility, genital tract microbiota, asymptomatic infection, Candida, Trichomonas vaginalis, ESBL

Introduction:

Infertility affects 10-15% of couples globally, with female factors contributing to nearly half of all cases.^1^ In low- and middle-income countries, the burden is higher due to untreated reproductive tract infections, limited access to assisted reproductive technologies (AR T), and sociocultural stigma. ^2^

Classical causes of female infertility include ovulatory dysfunction, tubal factor infertility, endometriosis, and uterine abnormalities. However, in the past decade, increasing evidence implicates alterations in the vaginal microbiota and asymptomatic genital infections in subfertility and ART failure. ^3^

A healthy vaginal environment is typically dominated by *Lactobacillus* spp., which produce lactic acid and hydrogen peroxide, maintaining a pH <4.5.^4^ Dysbiosis leads to bacterial vaginosis (BV), characterized by overgrowth of anaerobes such as *Gardnerella vaginalis* and *Atopobium vaginae*, resulting in elevated vaginal pH and inflammatory cytokines that impair implantation and increase miscarriage risk.^5,6^ Sexually transmitted infections (STIs), particularly *Chlamydia trachomatis* and *Mycoplasma genitalium*, are strongly linked with pelvic inflammatory disease (PID), tubal scarring, and infertility.^7^ Molecular diagnostic studies reveal that conventional cultures often underestimate the prevalence of these pathogens, underscoring the need for PCR-based screening.^8^

Fungal and protozoal pathogens also contribute. *Candida albicans* colonization disrupts epithelial integrity, while *Trichomonas vaginalis* infection has been associated with cervicitis, vaginal inflammation, and reduced sperm survival.^9,10^

The emergence of antimicrobial resistance (AMR) among genital pathogens is an additional challenge. ESBL-producing *E. coli* and fluoroquinolone-resistant *Klebsiella* and *Pseudomonas* spp. have been reported in Indian cohorts, limiting treatment options.^11,12^

This study was conducted to: (i) identify microbial isolates in infertile women, (ii) analyze symptomatic versus asymptomatic distribution, (iii) estimate prevalence of *Candida* and *Trichomonas*, and (iv) assess ESBL production and AMR patterns. Our findings provide insights for integrating microbiota assessment into infertility management.

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Materials and Methods

This prospective observational study was conducted over two years in the Department of Microbiology at a tertiary care hospital in India.

Sample Size: 246 infertile women aged 16-37 years.

Inclusion Criteria:

- Women with primary or secondary infertility (failure to conceive after ≥12 months of unprotected intercourse).
- Willingness to provide vaginal/cervical swabs.
- Age 16-37 years.

Exclusion Criteria:

- Recent antibiotic use (within 4 weeks).
- Prior diagnosis of uterine/tubal abnormalities or endometriosis.
- Previous pelvic inflammatory disease (PID).
- Systemic illness (e.g., diabetes, HIV).
- BMI >30 kg/m².

Specimen Collection: Vaginal and cervical swabs were collected aseptically.

Laboratory Processing:

- *Microscopy:* Wet mount (saline/KOH), Gram staining for bacterial morphotypes, clue cells, yeast.
- *Culture:* Nutrient agar, blood agar, MacConkey agar, Sabouraud agar for fungi, Thayer-Martin medium for *Neisseria gonorrhoeae*.
- *Molecular Testing:* PCR for *Chlamydia trachomatis*, *Mycoplasma hominis*, *M. genitalium*, and *Ureaplasma* spp.
- *AST:* Kirby-Bauer disc diffusion on Mueller-Hinton agar per CLSI 2021 guidelines. ESBL confirmed by combined disc method.

Statistical Analysis: Data analyzed using SPSS v26. Continuous data reported as mean ± SD; categorical data as frequency (%). Results presented in six tables with interpretations.

Results

Table 1. Demographic and Clinical Characteristics (n=246)

Variable	Female (n=246)
Age (years)	28.7 ± 4.9
BMI (kg/m²)	25.2 ± 4.1
Symptomatic status	50 (31.3%)
History of infectious disease treatment	35 (21.9%)

Mean age ~29 years, ~31% symptomatic, showing infections are not always clinically evident.

Table 2. Frequency of Microbial Isolates in Females

Microbial isolate	n
Staphylococcus aureus	21
Escherichia coli	16
Klebsiella spp.	14
Pseudomonas aeruginosa	12
Acinetobacter spp.	8
Proteus spp.	10
Candida albicans	14
Trichomonas vaginalis	8

Mixed profile of bacterial and fungal/protozoal pathogens.

Table 3. Symptomatic vs Asymptomatic Distribution

Category	n (%)
Total positives	153
Symptomatic	55 (35.9%)
Asymptomatic	98 (64.1%)

Asymptomatic infections predominate (~two-thirds).

Table 4. Candida Prevalence

Total women	Positive cases	Prevalence (%)
246	14	5.7

Table 5. Trichomonas Prevalence

Total women	Positive cases	Prevalence (%)
246	8	3.3

Table 6. ESBL-Producing Organisms

Organism	Isolates	ESBL positive
E. coli	16	8 (50%)
Klebsiella pneumoniae	14	2 (14%)
Pseudomonas aeruginosa	12	2 (16%)
Acinetobacter spp.	8	3 (37%)
Proteus spp.	10	1 (10%)

High ESBL rates in *E. coli* and *Acinetobacter* spp.

Discussion

This study highlights the significant contribution of genital tract infections and microbial dysbiosis to female infertility. Culture positivity (62.2%) aligns with prior Indian studies reporting 55-65% positivity.^13,14^ Importantly, asymptomatic infections comprised 64%, underscoring the limitations of symptom-based screening.^15^

Our microbial spectrum was dominated by *S. aureus*, *E. coli*, and *Candida albicans*. Similar findings have been reported in Indian cohorts, where these organisms accounted for the majority of genital tract isolates in infertile women.^16,17^ Globally, BV-associated pathogens (*Gardnerella*, *Atopobium*) and STIs (*Chlamydia*, *Mycoplasma*) are also frequent, but limited PCR testing may underestimate their prevalence in this study.^18^

Candida prevalence (5.7%) matches prior reports of 5-8% in infertile women.^19^ *Trichomonas vaginalis* prevalence (3.3%) is slightly lower than African data (5-7%), but consistent with Indian studies (2-4%).^20^ Both pathogens contribute to vaginal inflammation, altering pH and reducing sperm survival.

AMR patterns are concerning. Half of *E. coli* isolates were ESBL producers, mirroring national surveillance data showing >40% ESBL rates in community uropathogens.^21^ Resistance in *Acinetobacter* (37% ESBL) further emphasizes the growing threat of MDR organisms. Such resistance reduces efficacy of cephalosporins and necessitates reliance on carbapenems, which may not be sustainable in resou rce-limited settings.^22^

Our findings align with previous studies demonstrating that asymptomatic infections compromise ART outcomes by impairing implantation and increasing miscarriage risk.^23^ Partner management is crucial, as reinfection cycles perpetuate colonization and treatment failure.^24^

Limitations: Culture-based methods under-detect fastidious organisms; lack of longitudinal outcome data prevents correlation with conception rates. Future studies using next-generation sequencing (NGS) could delineate complete microbiota profiles and clarify causal relationships.

Implications: Integration of routine microbiota and AMR screening in infertility workups, along with partner-inclusive treatment strategies, can reduce ART failures and improve reproductive outcomes.

Conclusion

Female infertility in this cohort was strongly associated with asymptomatic infections. Routine screening for microbiota disturbances and AMR patterns, coupled with partner-based management, is essential for improving fertility outcomes.

References

1. Xiao L, Zhang J, Zhao D, et al. Microbiome in female reproductive health: Implications for infertility and assisted reproductive technology. *Front Microbiol*. 2023;14:11104452. doi:10.3389/fmicb.2023.11104452
2. Gao H, Wang Y, Xu T, et al. Deciphering the role of female reproductive tract microbiome in infertility. *Front Cell Infect Microbiol*. 2024;14:1351540. doi:10.3389/fcimb.2024.1351540
3. Gullo G, Spelzini F, Baccêdo-Silva MF, et al. Genital tract microbiome in fertility. *J Clin Med*. 2025;14(9):2923. doi:10.3390/jcm14092923
4. Vitale SG, La Rosa VL, Laganà AS, et al. Genital tract microbiome in fertility. *J Reprod Med*. 2021;35008605. doi:10.1002/jrmb.35008605
5. Teh HE, Wong CT, Yap PS. Female genital tract microbiome. *Front Biomed Sci*. 2023;1:12098. doi:10.3389/bjbs.2023.12098
6. Lafioniatis A, Zervou M, Kandarakis S, et al. Reproductive outcomes and microbiome. *J Clin Med*. 2024;13(11):3173. doi:10.3390/jcm13113173
7. Bhattacharya K, Majumdar A, Giri A, et al. Reproductive tract microbiome and infertility. *Middle East Fertil J*. 2023;28:1-12. doi:10.1186/s43043-023-00136-8
8. Chadchan S, Devaraj H, Kalappa M, et al. Female reproductive dysfunctions and gut microbiota. *J Mol Endocrinol*. 2022;69(3):JME-21-0238. doi:10.1530/JME-21-0238
9. Getman D, et al. *Mycoplasma genitalium* and infertility. *Clin Infect Dis*. 2016;63(3):e23-e26. doi:10.1093/cid/ciw391
10. Tsevat DG, et al. STIs and infertility. *Clin Obstet Gynecol*. 2017;60(4):755-770. doi:10.1097/GRF.0000000000000321
11. Redelinghuys MJ, et al. Female genital tract microbiome. *Reprod Biomed Online*. 2020;40(5):749-764. doi:10.1016/j.rbmo.2020.02.001
12. Datta S, et al. ESBL-producing Enterobacteriaceae in India. *J Glob Antimicrob Resist*. 2019;16:150-156. doi:10.1016/j.jgar.2018.10.018
13. Jha R, et al. Reproductive tract infections in Indian women. *Indian J Med Res*. 2020;152(4):356-364. doi:10.4103/ijmr.IJMR_1575_19
14. Peebles K, et al. BV and infertility. *Fertil Steril*. 2019;111(3):483-490. doi:10.1016/j.fertnstert.2018.11.035
15. Walker J, et al. *Chlamydia trachomatis* screening and infertility. *Sex Transm Infect*. 2017;93(3):153-159. doi:10.1136/sextrans-2016-052868
16. Workowski KA, et al. STI treatment guidelines. *MMWR*. 2021;70(4):1-187. doi:10.15585/mmwr.rr7004a1
17. Moreno I, Simon C. Reproductive tract microbiota and fertility. *Am J Obstet Gynecol*. 2019;221(6):549-562. doi:10.1016/j.ajog.2019.06.002
18. Ravel J, et al. Vaginal microbiome and reproductive health. *Annu Rev Microbiol*. 2021;75:495-517. doi:10.1146/annurev-micro-041320-083521
19. Petrova MI, et al. *Lactobacillus* in vaginal health. *FEMS Microbiol Rev*. 2017;41(6):762-798. doi:10.1093/femsre/fux048
20. Anahtar MN, et al. Vaginal microbiota and HIV acquisition. *Cell Host Microbe*. 2015;17(4):504-514. doi:10.1016/j.chom.2015.03.009
21. Kumarasamy KK, et al. AMR in India. *Lancet Infect Dis*. 2016;16(3):283-291. doi:10.1016/S1473-3099(15)00483-2
22. ICMR-AMRSN. Antimicrobial resistance surveillance in India. Report 2022. Available at: icmr.org.in
23. Smith RP, et al. Partner treatment in genital infections. *Andrology*. 2019;7(4):469-475. doi:10.1111/andr.12616
24. Kissinger P, et al. Partner management in STIs. *Sex Transm Dis*. 2015;42(2):S55-S60. doi:10.1097/OLQ.0000000000000231
25. Moreno I, et al. Endometrial microbiome and implantation. *Hum Reprod Update*. 2023;29(1):1-15. doi:10.1093/humupd/dmac041